Titanium Welding

Status: Transitioned

PROBLEM / OBJECTIVE

The Navy selected commercially pure (CP) titanium in place of copper-nickel for many of the seawater piping systems on the new LPD-17 landing platform dock. The excellent erosion and corrosion resistance of titanium will permit these pipes to last for the 40-year life of the ship, instead of requiring periodic replacement. This conversion to titanium will save millions of dollars in the life-cycle costs on each ship. Savings will increase as the use of titanium piping is expanded to future ship designs. Fabrication of titanium piping presents new challenges for shipbuilders that have little previous experience welding this material. The NJC worked on a titanium welding project with the Naval Sea Systems Command Materials Group (05M) and Northrop Grumman Ship Systems, Avondale Operations to develop welding and inspection procedures that maximize quality and productivity while minimizing the cost of introducing titanium piping to shipyards.

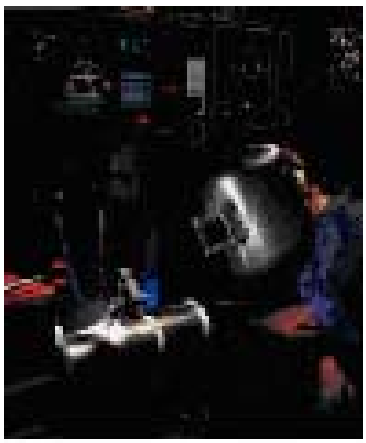
ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The Navy Joining Center, along with the Naval Sea Systems Command and Northrop-Grumman Ship Systems Avondale Operations developed and implemented high-quality and cost-effective welding procedures and nondestructive testing (NDT) procedures for titanium seawater piping on the LPD-17. Weld color charts and workmanship samples were produced to show acceptable welds as well as welds that have unacceptable levels of contamination. Portable hardness and eddy current inspection methods that determine when a weld has become embrittled also were developed and transitioned to NGSS.

Implementation and Technology Transfer:

The technology developed during this project is being used at Northrop Grumman Ship Systems, Avondale Operations in the production of seawater piping systems on the Navy's new LPD-17 class ships. The NJC provided training on titanium welding practices to Pearl Harbor Naval Shipyard, Northrop-Grumman Avondale Operations and Ingalls Shipbuilding, and Bath Iron Works. Weld color workmanship samples and weld



color charts were provided to Navy and commercial shipyards and to Navy contractors. These tools are also available from a commercial source as the result of this project.

Expected Benefits:

The ROI for this project is estimated to be 10.9:1 over 5 years. Cost reductions result from increased productivity, reduced cost of repair of welds during manufacture and service, and reduced costs to introduce titanium welding technology into the shipyards. The new NDT tools and requirements developed during this project can be extended to other titanium welding applications.

TIME LINE / MILESTONE

Start Date: May 1998
End Date: December 2001

FUNDING

ManTech Investment: $1.4M

PARTICIPANTS

Northrop-Grumman Avondale Operations
Naval Sea Systems Command Materials Group (05M)
Edison Welding Institute